

Habitat Cost Effective Energy Retrofit Program Mixed - Humid and Cold Climate

Dow Building Solutions
Michigan State University
Ferris State University

Habitat for Humanity International
Habitat for Humanity affiliates of greater Chicago
area

Habitat for Humanity of Kent County
Habitat for Humanity of Michigan

Mixed – Humid (& Cold) Retrofit Case Study

OH, IN, & MI Retrofit
Air Leakage Case Study
a Collaboration with
Duke Energy

Mike Mazor. Ph.D.
Dow Building Solutions

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Professor Michigan State University

Acknowledgements

- Kate Johnson, Dow Chemical Company
- Doug Bibee, Dow Chemical Company
- Don Nelson, DR Nelson & Associates

2009 Study Details

- 15 existing homes
 - Dating between 1926 and 2001
- Michigan, Indiana, and Ohio
- Limited to air sealing and testing in one day using One/Two Component Foam
- Measurement of time/material/location
- Blower door test before and after each change
- REM/Rate calculations to estimate annual energy savings attributed to reduced air leakage

Home Selection



1926

1940

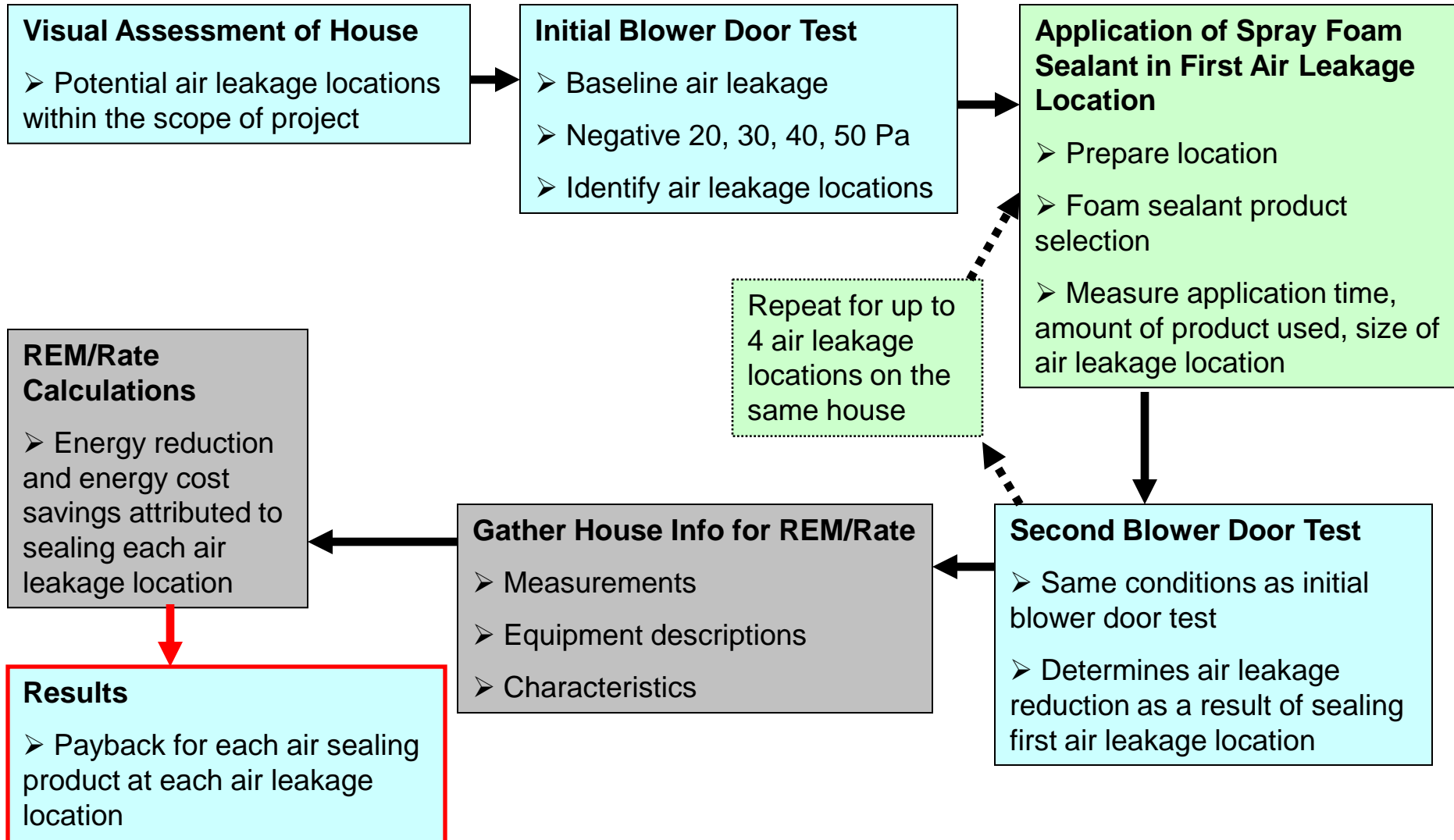
1965

1980

2001



Procedure



Before



Sill plate
& Rim Joist



Window

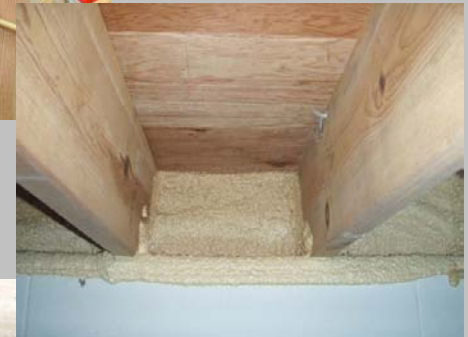


Rim Joist



Rim Joist on
Block Wall

After



Case Study #1



Built in 1926

Take-away: Every Home is “unique” Construction



Built in 1926 with Balloon Framing

Wall cavity continuous volume space with attic and floor.

Intermediate floor framing joists are face nailed directly to the studs.

The studs are continuous from top to bottom of the building.



Air Sealing Materials



Consumer spray can



Professional gun on can foam

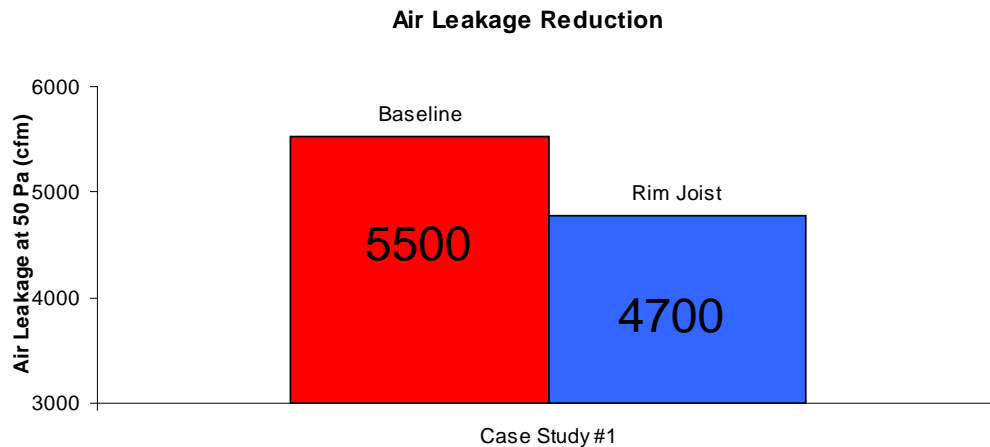
“DIY”

Contractor



Froth Pack Foam

Air Sealing of Rim Joist

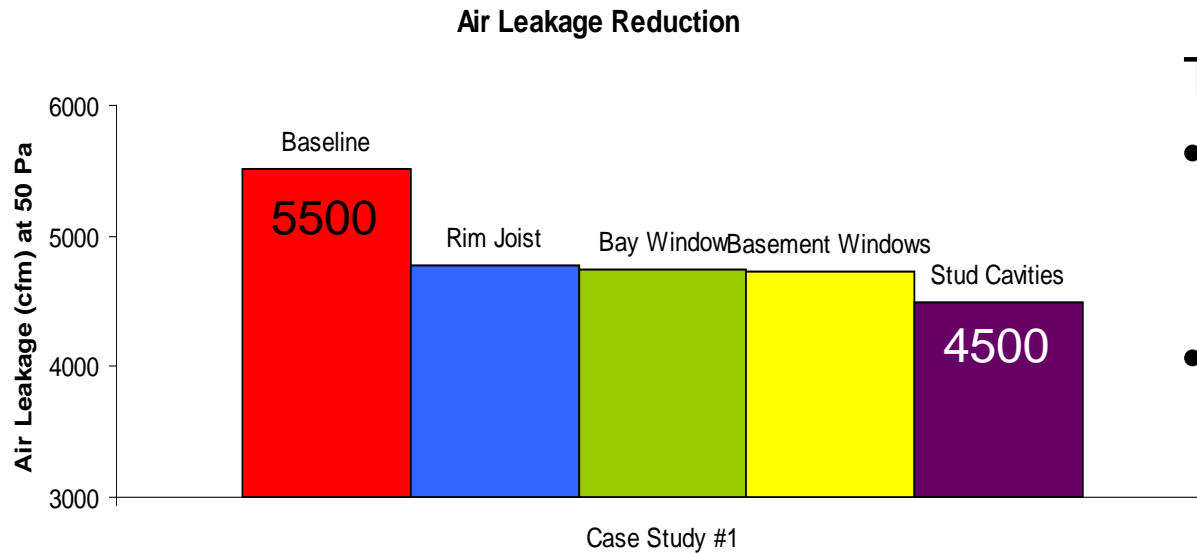


What was done:

- 95 linear feet of rim joist
- Product used: 2.5 cans w/ gun applicator
- Labor: 1.75 hours

Initial HERS Score	190	Initial ACH	1.3
After sealing rim joist	182	ACH after sealing rim joist	1.1

Series of Improvements



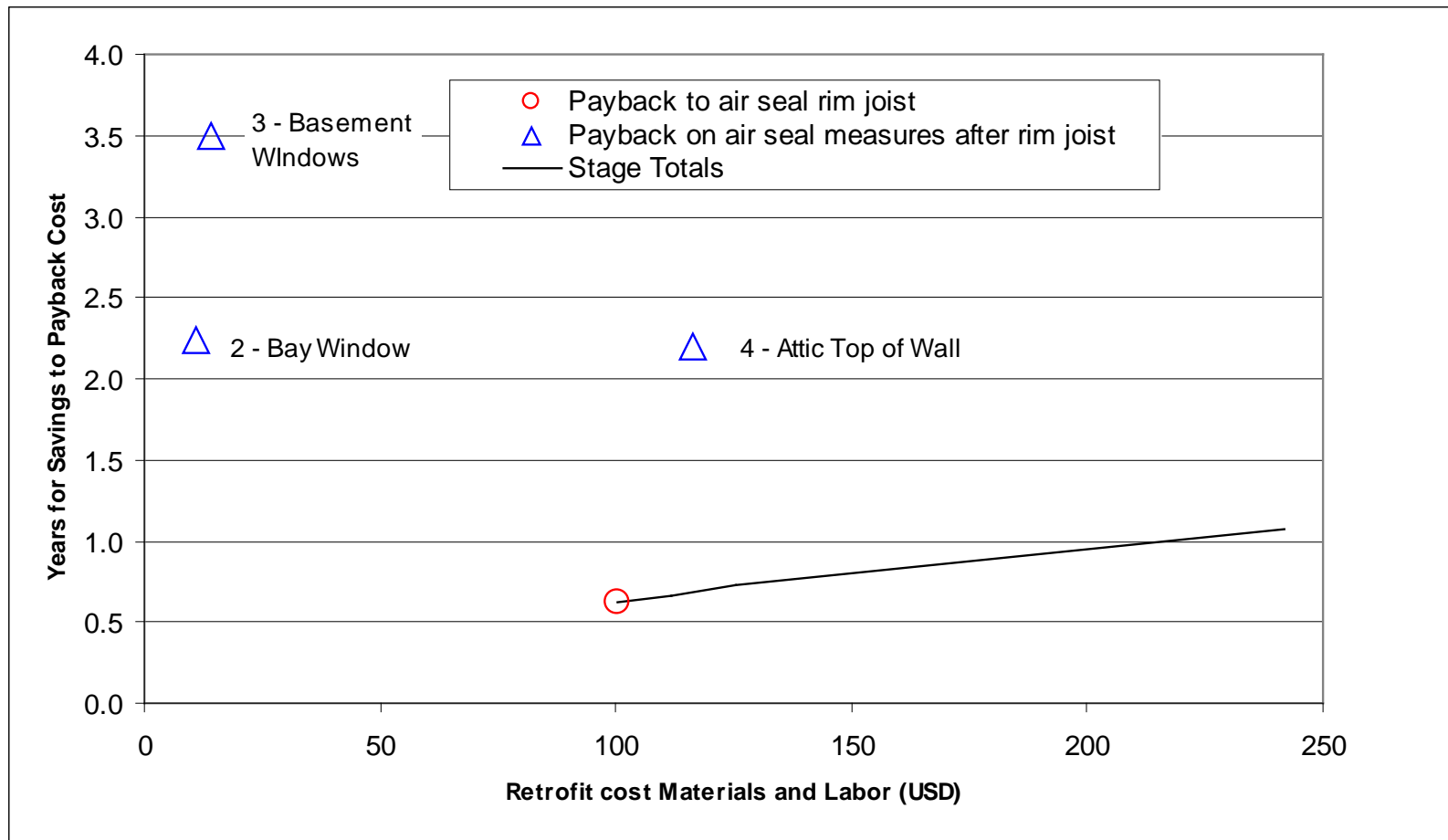
Totals:

- Product used: 5.5 cans w/ gun applicator
- Labor: 4.3 hours

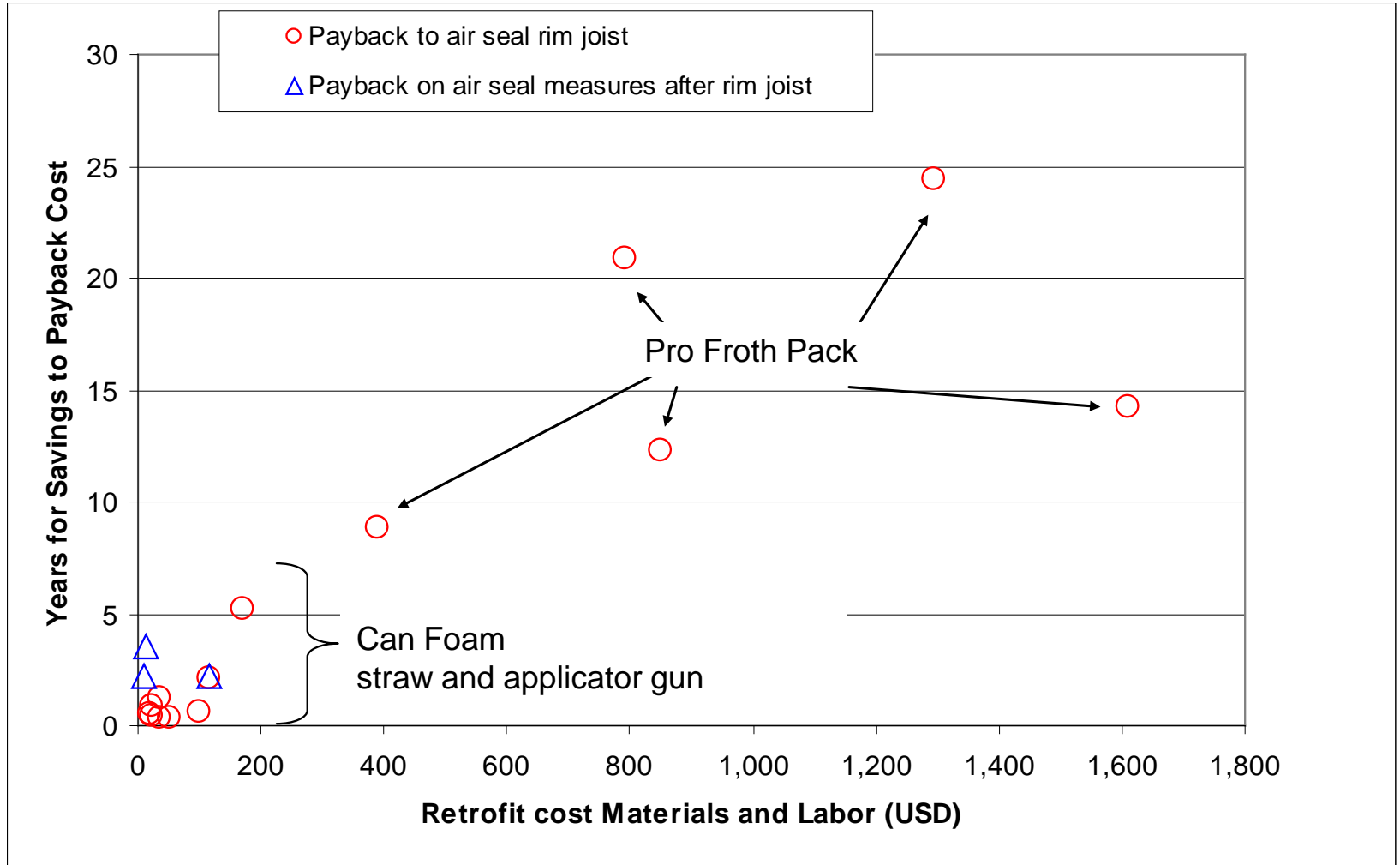
Initial HERS Score	190	Initial ACH	1.3
after	180	after	1.0

Sequence of Retrofits

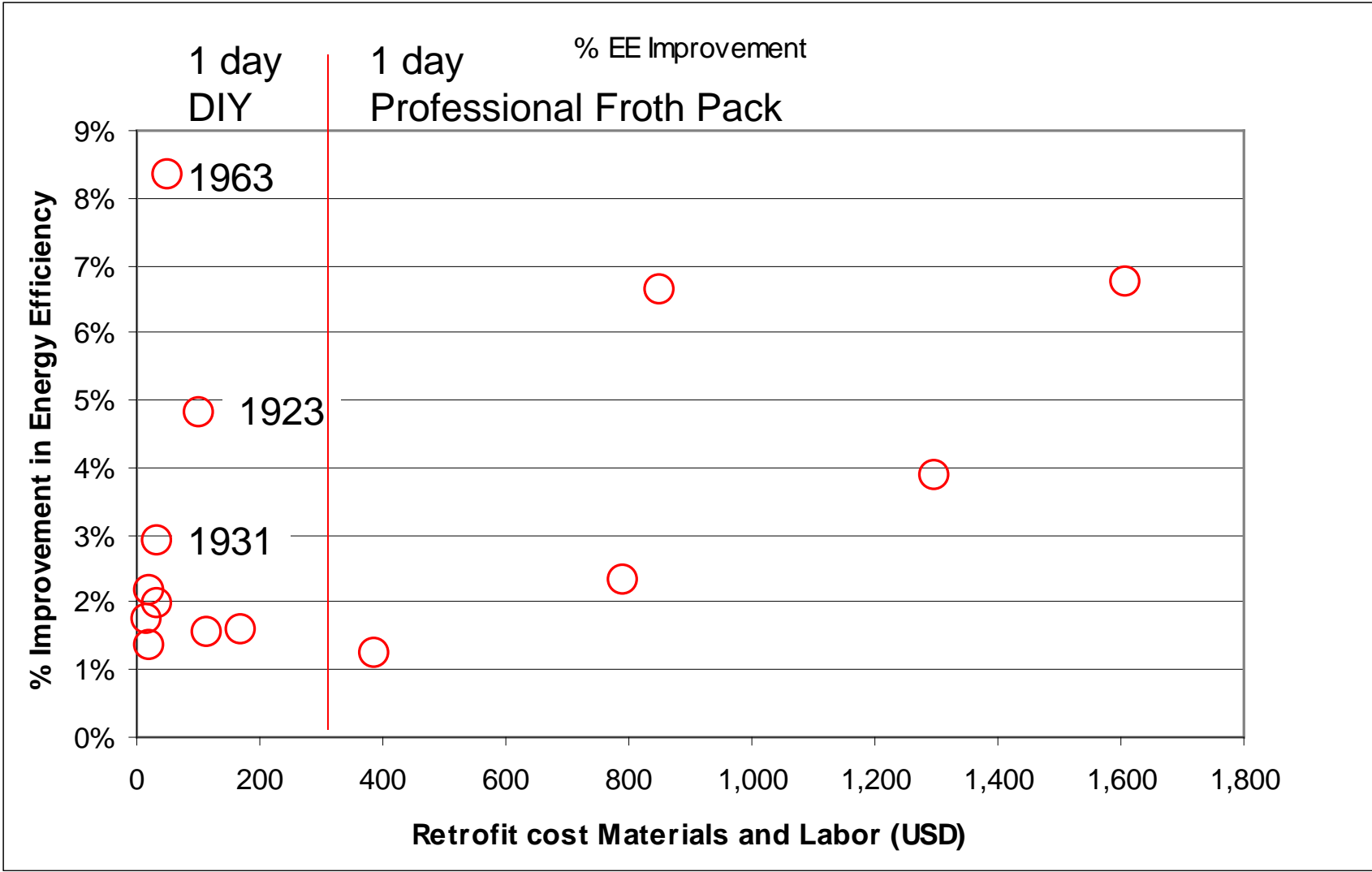
Impact on Pay Back



Payback for All Cases



% Energy Efficiency Improvement (REM/Rate Analysis)







Conclusions Air Sealing Case Study

- DIY Simple Air Sealing Can Provide very Quick Savings Payback
- % Energy Efficiency Improvement from simple one-day air sealing
 - Function of candidate home and type of improvement
- Candidate for Low Cost Prescriptive Package including Health, Safety, and Durability Measures

Gaps and Barriers

- Gaps in Energy Retrofit Market lie in understanding owner motivators, and barriers to owner investment in upgrades
- Matching technology with market place
 - ID and Selection of Successful Candidate Structures

“Habitat Cost Effective Energy Retrofit Program for Mixed- Humid and Cold Climate Housing Stock”

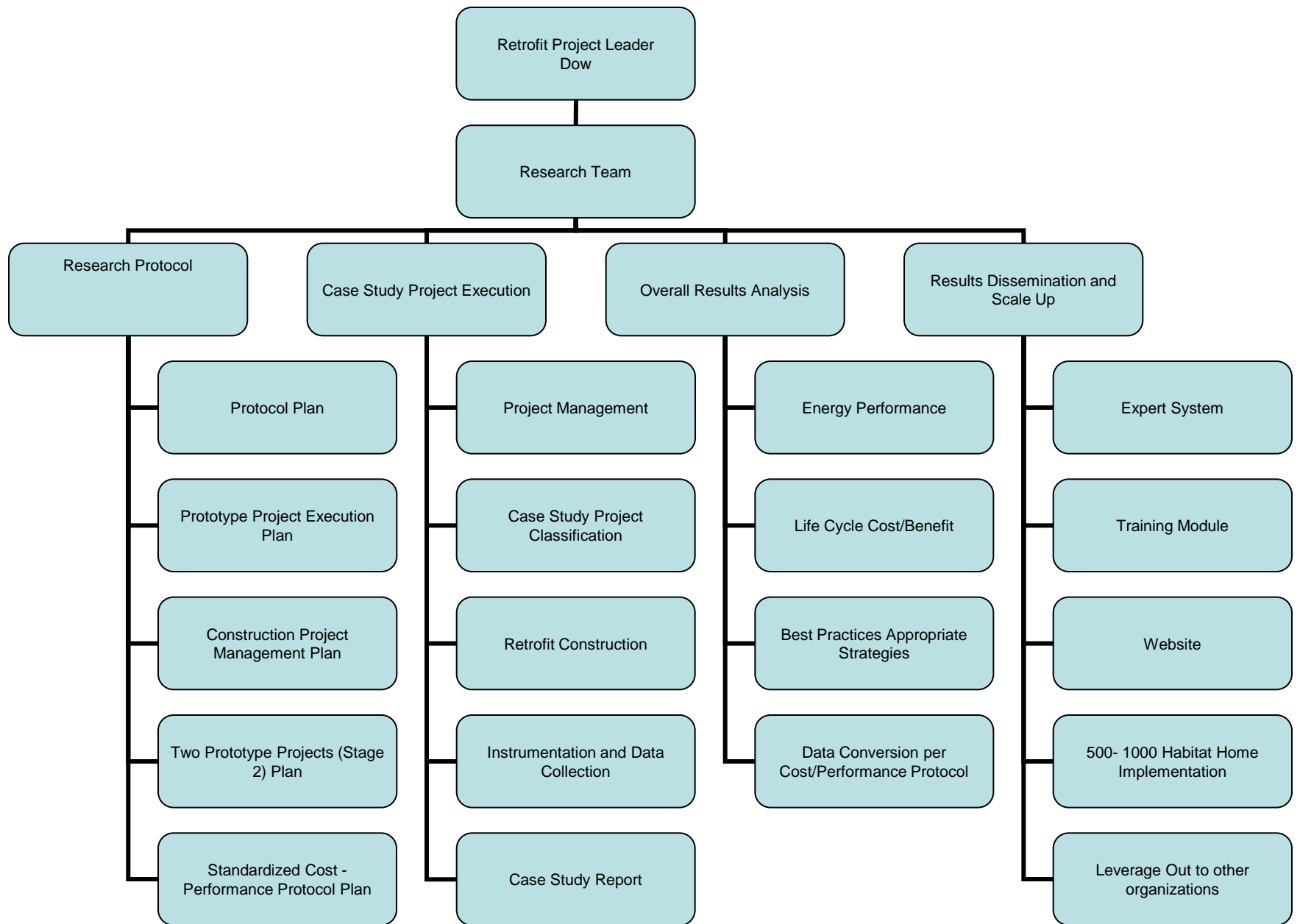
Company	Skills and Focus
<p>The Dow Chemical Company- Project Lead</p> 	<ul style="list-style-type: none"> • Manufacturer of insulation and air sealing products • Recognized building science leader and provides building science and research modeling expertise • Elected team leader for the project • Global company with extensive market penetration in the U.S. • Leading HFH Corporate Sponsor for many years and committed to helping HFH's global success
<p>Habitat for Humanity</p> 	<ul style="list-style-type: none"> • Provides access to existing housing stock identified for energy retrofits through HFH's local affiliates • Works within Gifts in Kind (GIK) program to collect materials through their GIK program and coordinate field construction deliveries and activities, professional installation where required.
<p>Michigan State University</p> 	<ul style="list-style-type: none"> • Brings architectural and engineering design expertise, project management proficiency within the Construction Mgmt program. • Leverages MSU graduate students to support the project's schedules, milestones, deliverables, data collection, reporting, project meetings, etc • Builds on existing strong Dow/MSU partnership.
<p>Ferris State University</p> 	<ul style="list-style-type: none"> • HVACR engineering and building science expertise. Applied technology research and best practice development. • National workforce certification expertise. • RESNET rater abilities • Builds on existing HFH/ FSU relationship
<p>Duke Energy, DTE and Exelon</p>	<ul style="list-style-type: none"> • Experience with a number of national energy efficiency programs with interest in exploring the deep energy retrofit market • Provides a utility perspective as well as utility bill acquisition, resource support on design teams

Project Objectives

- Determine cost-effective energy efficiency retrofit solutions to meet 30% and 50% efficiency gains
- Identify technology gaps for cost effective retrofits
- Assess and classify housing stock to identify high impact archetypes to achieve economies of scale
- Clarify the existing home retrofit market potential by housing stock type and geographic area;
- Identify potential policy tools that could provide incentives for homeowners to engage in retrofits
- Develop basic retrofit design strategies
- Develop two test homes and community-scale case studies

Project Objectives

- Work with stakeholders, including homeowners, to understand obstacles, successful models, opportunities providing a pathway to the future at every stage of the project
- Develop and communicate ‘best practices’, iteratively improving them as subsequent stages of the project progresses
- Develop a training and certification framework, leveraging the ‘best practices’ , market research, survey data and other lessons learned;
- Identify the need for product innovation that can address areas of need in accomplishing these deep energy retrofit products cost effectively
- Develop an expert system that enables the home owner or contractor to query the computer-based system in order to find prescriptive cost effective, energy efficient options.



Understanding the market place

- Match technical solutions with market conditions and preferences
- Identify high impact homes with high potential for ramp up
- Identify motivators of homeowners to invest in improvements
- Identify consumer or other barriers to investment in energy retrofits

Key Survey and Market Research Activities

- Market Assessment-Data Base Development-Housing Taxonomy
 - Workforce Focus Groups
 - Pre-retrofit and Post-retrofit Case Study Interviews
 - Homeowner's Survey-"Voice of Customer"
- Michigan State University Office of Survey Research (OSR)





Building & Construction

A business group of Dow Advanced Materials Division

Retail Team

Incentives for Energy Efficient Home Improvements
US Homeowner Study
to Support Development of HomeStar Legislation

June 2010



Study Objectives and Methodology

In June 2010, a survey of consumers was fielded via the Internet to gain insights to support:

- ❑ Development of incentive plans to encourage US homeowners to make their homes more energy efficient
- ❑ Understanding of...
 - Which proposed incentive plans have the highest potential
 - Which home improvement projects consumers would be more likely to do if an incentive plan were implemented
 - How various homeowner segments would respond to differing incentive plans
 - Past incentive plan participation and drivers of potential participation in a new plan offering.

The survey focused on homeowners between the ages of 22 and 64, with 41% of the respondent base being male and 59% female. With 1,575 completed responses, the overall survey has a margin of error of +/- 2.5 at the 95% confidence level. The concept evaluation, conducted with rotation, has a margin of error of +/- 6 at the 95% confidence level.



Insights: Home Improvement Projects Related to Energy Efficiency

Without an incentive, many homeowners have either never considered or are not planning to do the types of projects targeted by the proposed incentive program. Approximately one-quarter have already insulated their attic or exterior walls, replaced their HVAC system or

windows. Almost one-third have sealed gaps and cracks. 15% indicated that sealing ductwork did not apply to their home and 9% indicated that sealing gaps and cracks did not apply to their home.

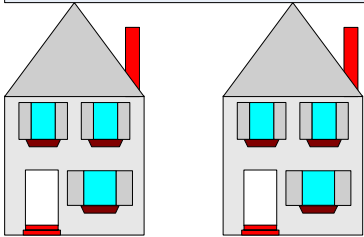
Energy Efficiency Project Disposition	Never considered	Not planning	Plan next 12 mos	Plan next 24 mos	Completed <12 mos	Completed >12 mos	Not applicable
Add insulation to the attic	22%	20%	12%	3%	6%	16%	18%
Insulate a basement	24%	10%	7%	4%	3%	8%	44%
Insulate a crawl space under the house	23%	9%	8%	3%	4%	8%	45%
Insulate exterior walls	32%	17%	9%	1%	4%	16%	19%
Replace a heating and/or air conditioning system	22%	21%	10%	6%	4%	22%	13%
Replace windows	17%	27%	10%	8%	6%	23%	8%
Seal ductwork to stop air leakage	28%	17%	10%	6%	8%	15%	15%
Seal the gaps and cracks that allow conditioned air to escape and outdoor air to enter the home	16%	21%	18%	6%	14%	17%	9%

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q1_A_Projlikely - Please indicate what level of consideration or action you have taken regarding each of the following home improvement projects for your current home.

Technical studies

Test Homes (2) (TASK 8)



Test House A

Test House B

Select test homes with diverse age and building style

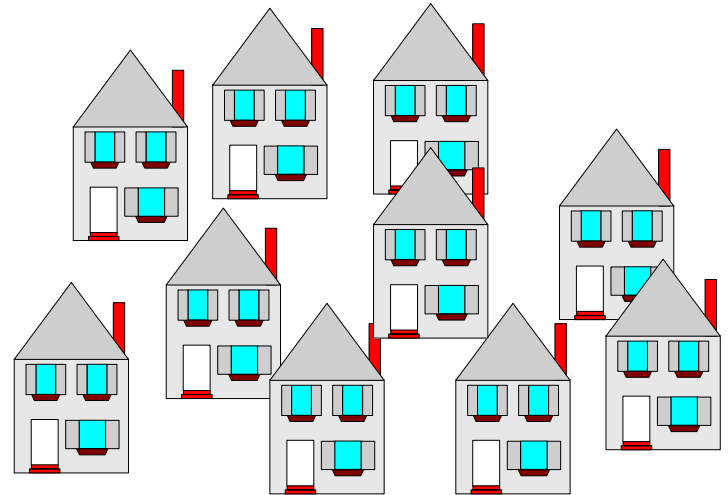
Leverage 'what' and 'how'

Incorporate individual measures:

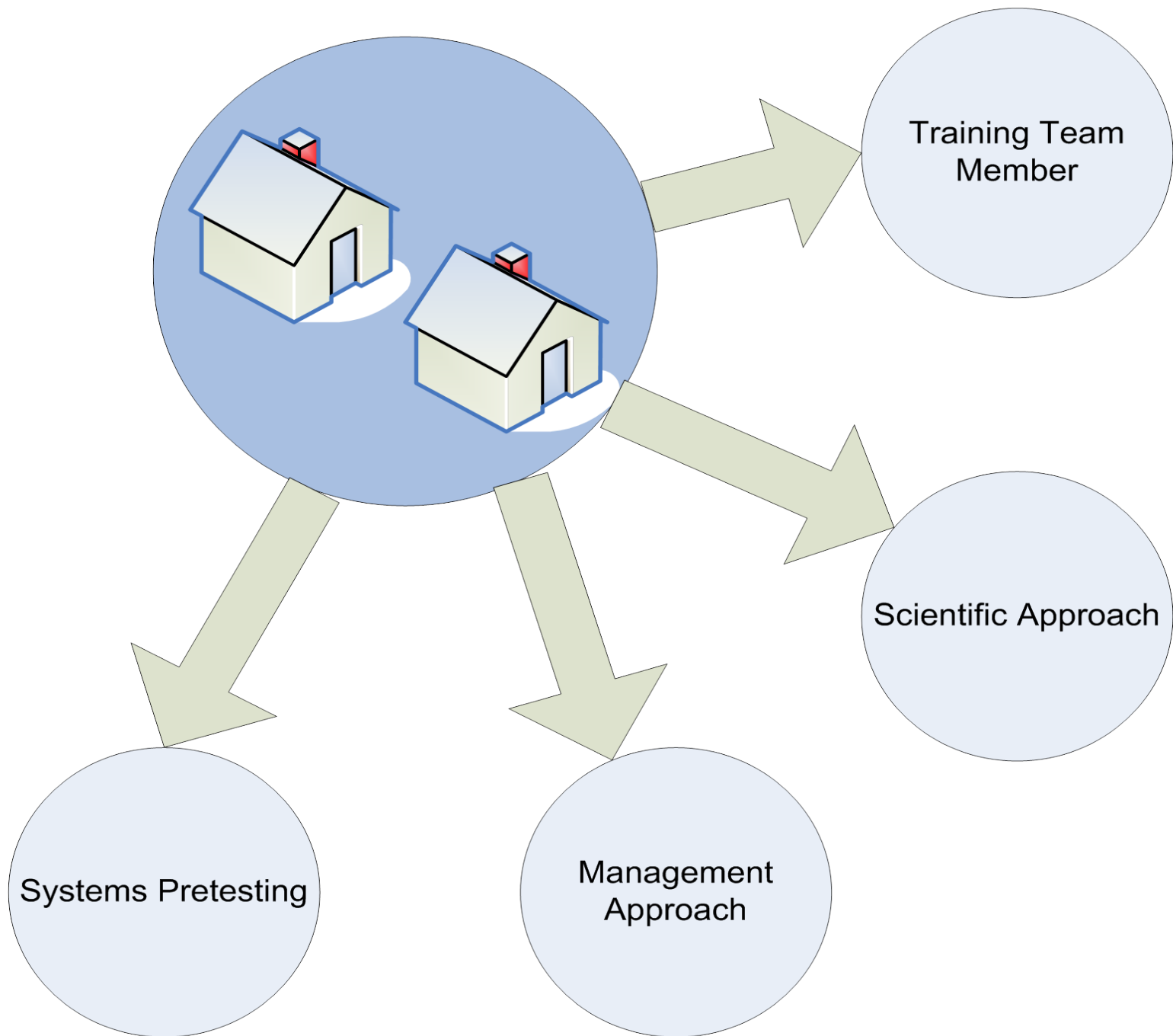
- *air sealing*
- *Insulation*
- *replace components*
- *solar components*

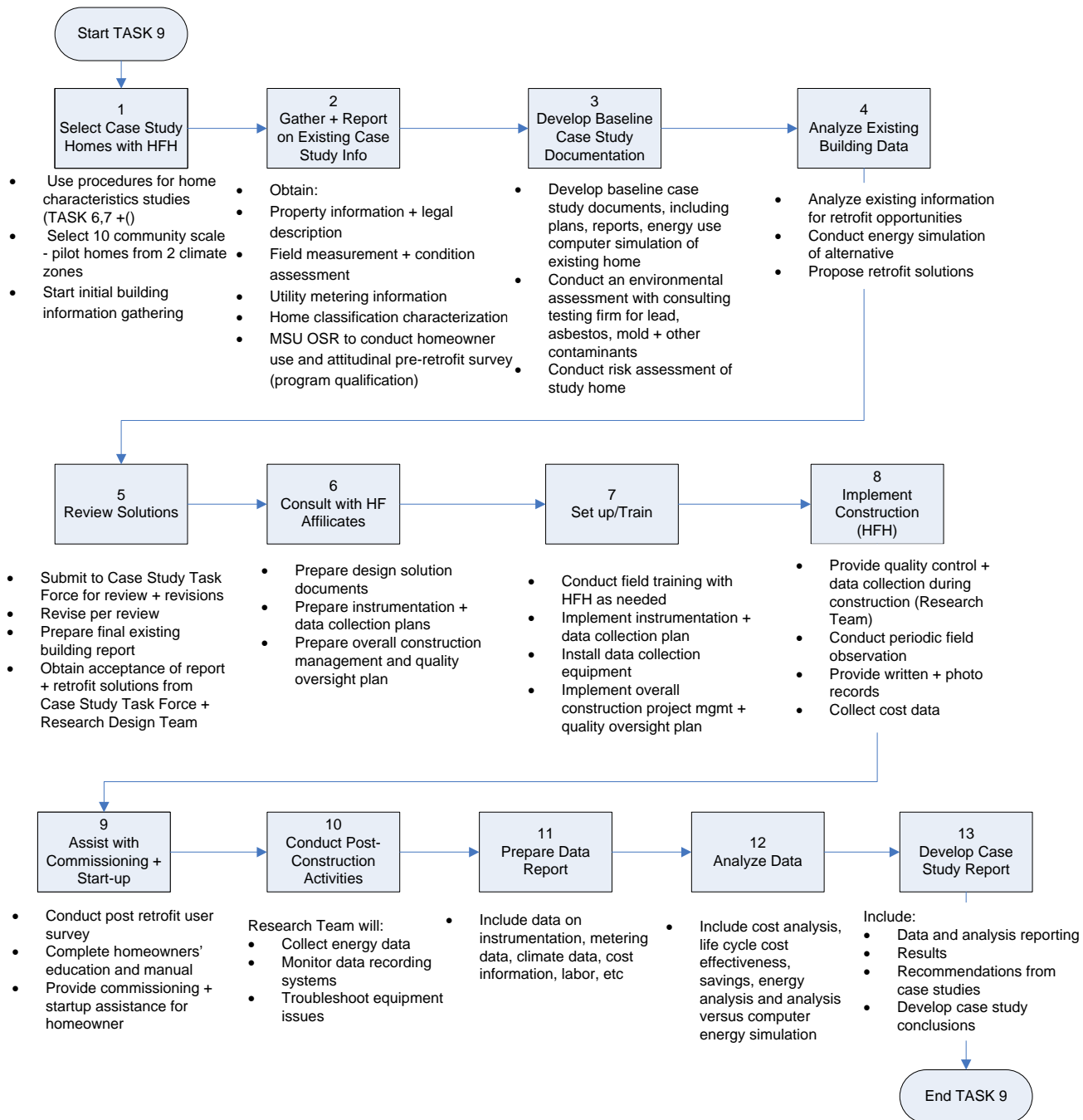
*Evaluate energy efficiency
Determine 'best practices' for
Community Homes - Pilot*

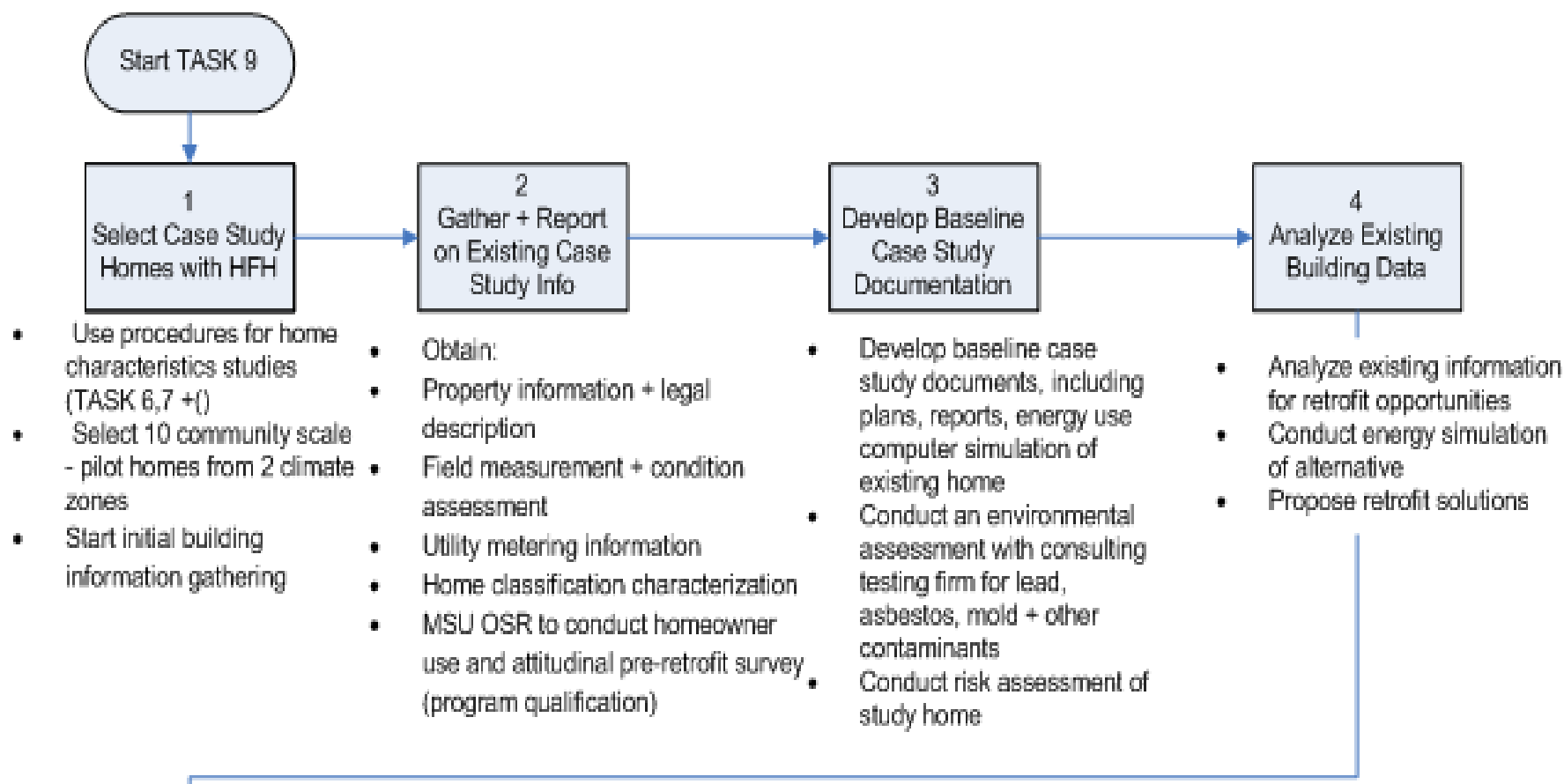
Community Scale – Pilot Homes (10 in base year in Cold Climate Zone) (TASK 9)

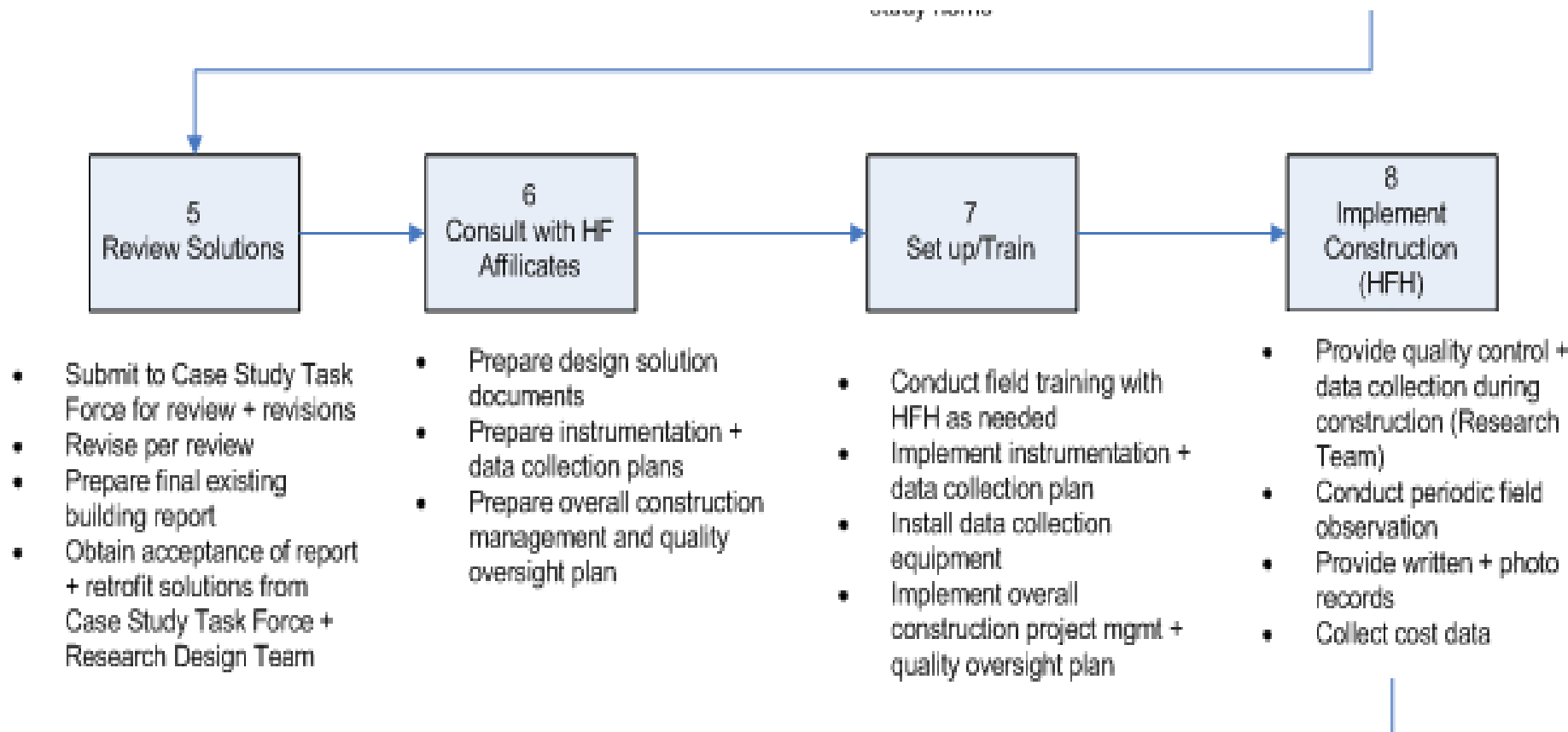


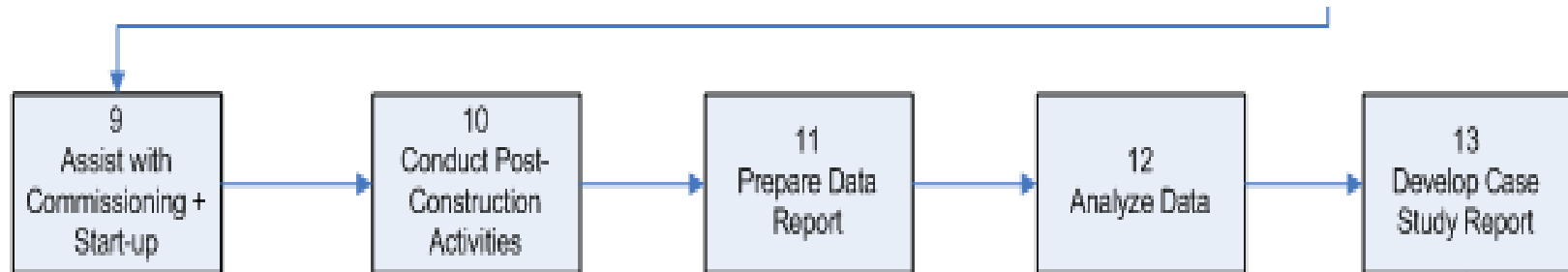
*Select community scale- pilot
homes with diverse age and
building style*











- Conduct post retrofit user survey
- Complete homeowners' education and manual
- Provide commissioning + startup assistance for homeowner

Research Team will:

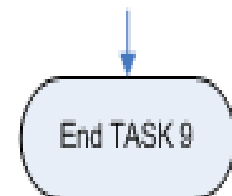
- Collect energy data
- Monitor data recording systems
- Troubleshoot equipment issues

- Include data on instrumentation, metering data, climate data, cost information, labor, etc

- Include cost analysis, life cycle cost effectiveness, savings, energy analysis and analysis versus computer energy simulation

Include:

- Data and analysis reporting
- Results
- Recommendations from case studies
- Develop case study conclusions



Synthesis Activities

- Synthesis of case studies
- Aggregate case study project reports
- Develop overall conclusions
- Identify prescriptive packages
- Identify best practices

Synthesis Activities

- Develop contractor/installer industry documents, details, specifications
- Develop workforce skills training
- Develop expert system development team

Closing the gaps

- Identify best practices and most effective technical strategies matched to high impact archetypes
- Foster community scale implemented based on consumer motivations
- Develop consistent SOP and processes for large scale implementation
- Develop work force skill standard certification for training

Q and A